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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service, National Institutes of Health

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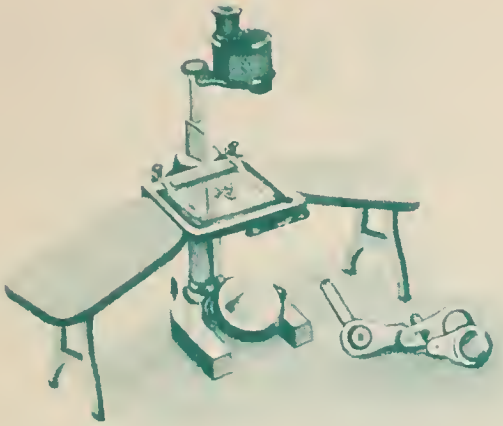
THE NATIONAL INSTITUTES OF HEALTH, a bureau of the Public Health Service, supports medical research and training in the Nation's medical schools, universities, and other research centers. It also conducts laboratory and clinical research in its own facilities at Bethesda, Maryland, and in the field.

The programs of the seven Institutes are designed to obtain new medical knowledge in order to control especially the major killing and crippling diseases of today, such as cancer, heart disease, arthritis, neurological disorders, and mental illness. The role of medical science in promoting better health and longer life is well recognized by the American people. Only through continued research leading to increased understanding of the causes, prevention, and treatment of disease can we become a healthier and stronger Nation.

We at the National Institutes of Health appreciate our great responsibility. We approach our work with humility, but with confidence that we can aid materially in man's conquest of disease.

James A. Shannon

JAMES A. SHANNON, M. D.
Director, National Institutes of Health



Growth and Progress

At the beginning of this century, the average newborn child in the United States could be expected to live only 47 years. Today the average life span is 70 years. The principal reason for this gain has been the progress of medical science, particularly against infectious diseases.

Among contributing agencies has been the Public Health Service. Since its creation by Congress in 1798, this organization—first named the Marine Hospital Service—has shouldered a steadily increasing responsibility. Today its various services and facilities, such as those of the National Institutes of Health, form an important part of the Nation's public health resources.

The Service has conducted medical research since 1887, when a laboratory of bacteriology was established on Staten Island, N. Y. This was in response to the urgent need to guard against epidemics that might arise from persons entering the country. Dr. Joseph J. Kinyoun, director of the new laboratory, was the first to detect the cholera organism among immigrants to America.

The leading causes of death at that time were infectious diseases—pneumonia and influenza, tuberculosis, intestinal disorders. But those were also the days of Pasteur, Koch, and Ehrlich. They were days of discoveries that offered not only effective health weapons, such as diphtheria antitoxin, but also basic principles that launched an era of great progress in medical science.

From the Public Health Service's laboratories, now centered largely in the National Institutes of Health at Bethesda, Md., have come knowledge and techniques that made possible the control of many communicable and nutritional diseases. Illustrative advances are the recognition that pellagra results from a dietary deficiency; the development of a vaccine and serum against Rocky Mountain spotted fever; vaccines for typhus and mumps; and the discovery of several diseases—ariboflavinosis, Louisiana pneumonitis, rickettsialpox.

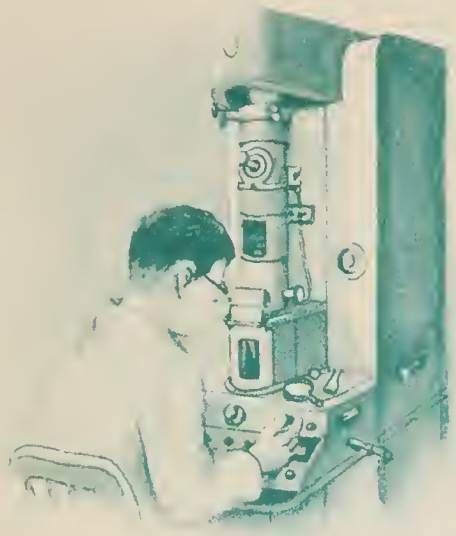
Before World War II, major trends were apparent in the Nation's health. Sanitation, better nutrition, improved medical treatment had all contributed to longer life; and more people were subject to the ills of an aging population—the so-called chronic diseases. Their control would require new knowledge, new basic principles that only research could provide.

Accordingly, Congress authorized in 1937 the National Cancer Institute, dedicated to research against the disease that had risen from eighth to second place as a cause of death in this country. For five years after the war, the scope was extended. Six additional research Institutes, some incorporating older laboratories, were established at Bethesda, each to work in a problem area such as heart disease or mental illness.

The Institutes were organized not only to conduct research, but also to support research projects, fellowships, training, teaching, and the construction of research facilities in America's universities and medical institutions. A Division of Research Grants was established at the National Institutes of Health to coordinate and expedite the grants and fellowships.

In 1953 the Clinical Center, a 500-bed facility for clinical-laboratory research, was opened at NIH, enabling all the Institutes to increase their study of patients and rounding out their programs.

1798	President John Adams signs bill establishing Marine Hospital Service for merchant seamen.
1887	Research laboratory is founded at Marine Hospital, Staten Island, N. Y., to meet new responsibilities of Service.
1891	Hygienic Laboratory moves from Staten Island to Service headquarters, Washington, D. C.
1912	Name of Public Health & Marine Hospital Service changed to Public Health Service.
1930	Hygienic Laboratory becomes National Institute of Health.
1937	Congress authorizes National Cancer Institute.
1938	National Institute of Health moves to land donated by Mr. and Mrs. Luke I. Wilson at Bethesda, Md.
1947	Division of Research Grants established to process NIH grants and fellowships to non-Federal institutions and scientists.
1948	National Heart Institute authorized; other laboratories regrouped to form Microbiological Institute, Experimental Biology & Medicine Institute, and National Institute of Dental Research. NIH becomes National *Institutes* of Health.
1949	Mental hygiene program of Public Health Service transferred to NIH and expanded to become National Institute of Mental Health.
1950	National Institute of Neurological Diseases & Blindness and National Institute of Arthritis & Metabolic Diseases established, the latter absorbing Experimental Biology & Medicine Institute.
1953	Public Health Service becomes a constituent of newly created Department of Health, Education, & Welfare; Clinical Center opens.
1955	Three Divisions formed—Biologics Standards, Research Services, and Business Operations. National Microbiological Institute becomes National Institute of Allergy & Infectious Diseases.



Medical Research Today

As medical science advances, it must deal with ever more subtle problems. True, the problems of yesterday were no less difficult then; but a real change has occurred in the scientist and his approach. Knowledge has grown so vast that today's scientist must be a specialist, and in order to draw from other specialties, he must often work in a team. Moreover, the complexity and precision of his equipment have necessarily increased. It is because of these trends that medical science today requires coordination, special training, and research centers like the National Institutes of Health.

Two studies in immunology will illustrate this growing complexity. In 1900 physicians faced a serious problem in the use of serums for immunization. Some patients when given antitoxin against diphtheria or tetanus reacted violently, and there were occasional deaths. At first these effects were blamed on the dangerous organisms with which the serums were made. But two scientists of the Public Health Service, Drs. Rosenau and Anderson, showed in 1906 that serum without antitoxic properties would produce such reactions in guinea pigs, if injected twice. In other words, the first injection produced a sensitivity to the serum: the animals were then "allergic."

A simple experiment had led to a major practical discovery. It became the rule to test the patient's response to serum before giving a full dose. Furthermore, the scientists were soon able to state the important principle that allergy to a foreign substance in the body—serum, pollen, sometimes certain foods—results from the formation of antibodies, and is thus related to the process of immunization against infectious organisms. The new concept of allergy greatly extended the science of immunology.

Today, allergy still presents many mysteries. Why are some people allergic, hypersensitive, to certain substances? Is allergy responsible for some diseases of unknown origin? In the National Institute of Allergy and Infectious Diseases, workers seek to determine whether rheumatic fever is an allergic reaction and to identify the sensitizing agent. Rheumatic fever, a major cause of heart damage, is usually preceded by a streptococcal throat infection, and the time lag between the conditions suggests that antibody formation is involved.

The problem of these scientists is to learn which fraction of streptococcus, among 40-odd types of the organism, may act as the sensitizing agent, the antigen. The techniques used in the study are varied and delicate. Conclusions cannot yet be drawn, nor all the difficulties anticipated. These lie beyond the frontier.

The increasing subtlety of medical problems is marked by another trend: the rise of new scientific specialties, or disciplines. Early in the history of medicine, the study of anatomy was paramount. The resulting knowledge of the body's structure permitted systematic investigation of its functions—physiology—and of the changes wrought by disease—pathology. Against the background of these disciplines and chemistry arose the modern study of drugs, or pharmacology . . . and so it goes. Since World War II, the most rapidly emerging discipline has been biochemistry, a formidable supplement to the classical approaches.

Biochemistry seeks knowledge of the chemical reactions underlying the body's functions in health

and disease. Like pathology, it may be regarded not only as a specialty, but as an approach applicable in many fields—microbiology, pharmacology, neurology, chemotherapy, nutrition. The rise of biochemistry in medical research has resulted from two general conditions: a growing need and the availability of technical means.

The chronic diseases, such as cancer, arteriosclerosis, arthritis, and schizophrenia, require new knowledge of body processes in which chemistry is involved. In cancer, for example, science is dealing with fundamental aspects of growth. Arthritis is known to be temporarily relieved by hormones, the body's chemical messengers. In the neurological disorders—epilepsy, cerebral palsy, multiple sclerosis—damage has occurred in the body's system of control and communication. To cope adequately with such problems, we must explain them in chemical terms.

Means for doing so have been developed in recent years. An important tool of the biochemist is the Warburg apparatus, which enables the scientist to measure the activity of enzymes—natural accelerators of chemical reactions in tissues. A technique more recently applied is chromatography. This is used to separate various substances, such as the components of protein. Tracer studies with radioisotopes, byproducts of the wartime atomic development, constitute a third technique, the value of which could hardly be exaggerated.

Isotopes are employed in the study of metabolism—the body's use of foods as fuel and building materials to carry on life. Compounds are prepared in which the radioactive isotope of an element, such as carbon or iodine, is substituted for the natural form, enabling the scientist to trace the metabolism of the compound by means of a Geiger counter. Tracer and therapeutic uses of radioiodine, I^{131}, are illustrated by current experiments at the National Cancer Institute. In adequate doses, I^{131} can destroy thyroid tissue, and is therefore useful against some types of thyroid tumor; but other types lack capacity to take iodine from the blood. This problem and the genesis of cancer are being studied by tracing the uptake of I^{131} as chemically induced tumors develop in the thyroids of mice.

Research in metabolism, though often applied to a specific health problem, is gradually building toward an over-all view of body chemistry. For example, much progress has been made in mapping the numerous steps by which sugar in the body is converted to a usable form and finally burned to yield energy. Then, the means by which energy is harnessed are also being investigated. Such mechanisms involve vitamins, minerals, enzymes, and other substances. Intricate indeed is the jigsaw puzzle of metabolism, normal and abnormal; and a complete solution, certainly far in the future, would leave few mysteries of disease.

Biophysics, the science of matter and motion as related to life, is another expanding discipline that serves many fields. Again, new equipment and techniques have played a major part. For example, the electron microscope, about 100 times as powerful as earlier instruments, has extended the visualization of tissues to their smallest units, the molecules themselves. The ultracentrifuge, a high-speed whirling device, separates the particles composing cells. Other instruments that have opened new approaches are those used in the study of radiation, such as generators of subatomic particles in the multimillion-volt range.

Medical research today, as typified at the National Institutes of Health, requires not only competent scientists, but also supporting personnel and facilities. The investigators who plan and conduct research are aided by teams of trained assistants. Serving the Institute laboratories are such auxiliary departments as the centralized instrument shop, animal production colony, and scientific library. There is an organization for the maintenance of facilities and grounds. Finally, an administrative staff provides over-all coordination and management; and these elements together must constitute an environment conducive to creative effort.

The trends described above are merely illustrative; they do not give a rounded picture. Other emerging specialties include psychiatry, the social sciences, biostatistics. And long-established disciplines—surgery, endocrinology, genetics, and others previously mentioned—are more productive than ever. A rounded picture would also show the integration of various levels of study—the "test-tube stage," animal investigation, and clinical research.

But all types of medical research conducted today are represented at the National Institutes of Health and in the laboratories of its grantees. A broader picture is offered in the pages ahead.

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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NATIONAL INSTITUTES OF HEALTH
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BUREAU OF MEDICAL SERVICES
NATIONAL INSTITUTE OF NEUROLOGICAL DISEASES & BLINDNESS
NATIONAL INSTITUTE OF MENTAL HEALTH
NATIONAL CANCER INSTITUTE
NATIONAL INSTITUTE OF ARTHRITIS & METABOLIC DISEASES
NATIONAL INSTITUTE OF ALLERGY & INFECTIOUS DISEASES
NATIONAL HEART INSTITUTE
NATIONAL INSTITUTE OF DENTAL RESEARCH
DIVISION OF RESEARCH GRANTS
DIVISION OF BIOLOGICS STANDARDS
DIVISION OF RESEARCH SERVICES
CLINICAL CENTER
DIVISION OF BUSINESS OPERATIONS

National Institute of Allergy & Infectious Diseases

Infectious disease research is the oldest activity of the National Institutes of Health. In recent years the science of microbiology has shifted in emphasis and approach to meet new problems and to utilize newly acquired knowledge.

Although striking gains have been made against infectious illness, particularly the bacterial diseases, serious problems remain unsolved. Our knowledge of the viral diseases, for example, is inexact and fragmentary. Some of them, especially those of the upper respiratory tract, are so poorly understood that we cannot even assemble accurate figures on their prevalence.

At the National Institute of Allergy and Infectious Diseases, the approach to many health problems is centered in basic research. Nowhere is the need for such studies more acute than in the field of the allergic disorders. These widespread diseases have received little research attention, and their true extent is only beginning to be appreciated.

Child inoculated in evaluation of newly developed vaccine for influenza

Responsibility for fostering and conducting research on allergy was recently assigned to this Institute, known as the National Microbiological Institute until late in 1955.

Through biochemical and biophysical studies, scientists seek an understanding of the borderline between life and nonlife. They are investigating the structure and functioning of viruses, the smallest substances than can be called "living," and the role of proteins, largest of the "nonliving" molecules. Knowledge gained through such studies has important implications, not only for microbiology but for all the biological sciences.

In this work, scientists have been aided immeasurably by new and vastly improved techniques. Prominent is the culturing of viruses within tissues living in test tubes. A truly revolutionary tool, tissue culture has initiated a new era in research on virus diseases. It permits rapid propagation of viruses without the use of animals.

The significance of this advance is well illustrated by research on the common respiratory illnesses, a subject of intensive study at the Institute. Here is a problem that has long resisted solution, in part because scientists have been unable to isolate and maintain the causative agents. Tissue culture has at last overcome this obstacle, and Institute workers have been able to develop an experimental vaccine against one group of these viruses.

Within the past decade, scientists of these and other laboratories have discovered over 50 viruses in man, though not all are known to cause human disease.

Some representative diseases studied by the Institute are influenza, poliomyelitis, hepatitis, rheumatic fever, tuberculosis, encephalitis, and brucellosis. Problems range from the clinical evaluation of vaccines to the investigation of allergic factors and host-parasite relationships. Diseases of public health importance in the Western States are studied at a field laboratory in Hamilton, Mont.

The parasitic diseases, because of their worldwide distribution and their effect on our trade economy,

Examining a rabbit's eye infected with the microorganism of toxoplasmosis

are also under study here. While most of these diseases occur outside the country, a number of them are prevalent in the United States—amebic dysentery, trichinosis, and toxoplasmosis, to name a few. Many parasitic diseases are of particular interest to the military. For example, malaria was a major threat to our troops in Korea until better drugs were developed for treatment. In large part, the evaluation of these drugs in humans was carried out by Institute scientists.

A major project of the Institute is an investigation of the precise nutritional requirements of various kinds of cells in tissue culture. This work has broad significance, relating not only to virus research but also to fundamental growth problems such as cancer. It enables scientists to explore the interaction between host tissues and invading virus, and may throw light on the basic life processes in normal and malignant cells.

To augment research in its own laboratories, the Institute awards grants for investigations in allergy and microbiology at universities, medical schools, and other non-Federal institutions. Competitive fellowships in these fields of study are helping to develop the Nation's research manpower.

The Institute's clinical research program has greatly extended the attack on major infectious and parasitic diseases. The latter in particular remain to be adequately explored. Schistosomiasis and filariasis, for example, cannot at present be treated definitively, and even palliative treatment is poor. Clinical investigation of these diseases, which afflict millions throughout the world, emphasizes experimental therapy and the development of better methods of diagnosis.

Progress against the infectious diseases in recent years has been rapid and extensive, and the gains are continuing. In some respects the most challenging advance has been the growing awareness of the relation of infectious diseases to chronic disorders. Some of the latter are known to originate in infections that occur years before. Future progress against these chronic ailments depends in part on better understanding and more effective control of infections earlier in life.

Much of the work of the Allergy and Infectious Diseases Institute is related particularly to children—respiratory diseases, whooping cough, poliomyelitis, diphtheria, toxoplasmosis, and rheumatic fever. Children are still the principal victims of communicable diseases. All too frequently, these afflictions result in chronic illness or invalidism. The Institute strongly emphasizes these important and often far-reaching diseases of childhood.

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National Institute of Arthritis & Metabolic Diseases

Some of the oldest laboratories and best known discoveries of Public Health Service scientists are represented by the National Institute of Arthritis and Metabolic Diseases. The Institute incorporates the former Experimental Biology and Medicine Institute containing laboratories of biochemistry, nutrition, pathology, pharmacology, physiology, chemistry, and physical biology. In new areas of research, arthritis and the metabolic diseases are specifically attacked.

The Institute also awards grants to aid research in non-Federal institutions, fellowships to develop research talent, and clinical traineeships for studies in the prevention, diagnosis, and treatment of diseases in the Institute's field.

Laboratories now in this Institute have contributed significantly to the Public Health Service's record of progress. Achievements include the determination of the cause, prevention, and treatment of pellagra; the discovery that oral administration of ordinary table salt and baking soda dissolved in water holds promise as a mass emergency treatment for shock; and the development of synthetic drugs that make the United States potentially independent of foreign sources of opium.

The establishment of the Institute in 1950 followed a surge of interest in the rheumatic and metabolic diseases, stimulated by the momentous discovery that some arthritic patients are benefited by hormones—cortisone or ACTH. This indicated that hormonal balance and metabolism may be important factors in the cause and development of rheumatic disease. Cortisone and hydrocortisone, hormones from the adrenal glands, and ACTH, from the pituitary, cannot be regarded as curative in rheumatoid arthritis; but they have led to the rehabilitation of thousands and have greatly broadened arthritis research. The Institute is following up many new leads in this study area.

One major result, advancing the treatment of rheumatoid arthritis and certain other rheumatic disorders, was achieved late in 1954. Institute scientists discovered in clinical tests that two new

Handling ashes of rats that have received radioisotopes in tracer studies of metabolism

steroid compounds, prednisone and prednisolone, are three to four times as potent as their chemical relative cortisone and produce fewer side effects. The new drugs, under a variety of trade names, are now in common use.

By means of radioactive cortisone and other hormones, progress is being made in clinical tests to determine how these hormones are utilized in the body. This is part of the search for similar antirheumatic substances and for a better understanding of the causes of rheumatic disease.

A test has been developed which promises to be as specific for rheumatoid arthritis as the Wassermann test is for syphilis. This is being refined and made more sensitive.

Institute investigators in 1955 discovered the basic metabolic defect causing a fatal inherited disease of infants—galactosemia. Children with this disease were found to lack an enzyme detected in red blood cells of normal persons.

Although the Institute has made notable contributions to the knowledge of specific diseases, its laboratories are best known for their fundamental research. For example, the laboratory studying the chemistry of sugars has been a leader in this field for a quarter of a century. Physical biologists of the Institute have shared in the development of electron microscopy as a tool for learning how viruses multiply and for exploring the basic structures of cells. The enzymologists have advanced the understanding of complex chemical systems underlying tissue growth and function.

In general, the purpose of research at this level is to extend our knowledge of basic processes of life—knowledge frequently applicable against a specific disease. For example, the discovery that a single dose of gold thioglucose may permanently increase the appetite of a mouse provides a fundamental tool for obesity studies. A vitamin isolated here, the citrovorum factor, has shown promise in the treatment of certain anemias. In many instances, basic research adds to the picture of man's development—his growth, maturity, aging, and death.

In other laboratory studies, endocrinologists are methodically explaining the relation of the glands to the nervous system, especially as regards the metabolic diseases. Nutritionists are seeking new vitamins and determining their role in health, with notable success against degenerative diseases of the liver. Biophysicists are exploring the basic mechanics of respiration, muscle contraction, and other functions, largely under special conditions such as high altitude. Studies in pathology are conducted both as an independent approach and cooperatively with other NIH scientists.

In the Clinical Center, the Institute has developed a program which closely integrates the work of laboratory scientists and clinical investigators. Studies involving patients with rheumatoid arthritis, gout, liver diseases, diabetes, and various other metabolic disorders are under way.

An example of the projects made possible by the facilities of the Center is research on energy and mineral metabolism, utilizing a respiratory chamber. This is a specially equipped room, designed for determining the total energy expenditure of patients tested. To get a complete picture, nutrients and gases consumed are accurately measured, wastes are analyzed, and energy output is recorded. Such research is particularly important to the understanding of obesity.

Projects similar to those described above are supported under the Institute's program of research grants.

The Institute also administers the NIH Isotope Laboratory, in which all the Institutes conduct studies involving hazardous radiation.

Metabolic kitchen for preparing meals in which all ingredients are precisely measured

National Cancer Institute

Each year in the United States, nearly three-quarters of a million people are treated for cancer, and more than half a million of these cases are newly diagnosed. Approximately a quarter of a million cancer deaths occur annually. At prevailing rates, 16 out of every 100 people born are destined to die of this disease.

Cancer is a disease of cells. Once a cell has become malignant, the change appears to be irreversible and the cell reproduces in its new form. Cancers of various organs or tissues are apparently due to different causes, and therefore present different problems in cancer research and control.

The National Cancer Institute is attacking these problems through clinical and laboratory research, epidemiological studies, field investigations and demonstrations, educational programs, and the improvement and expansion of cancer services and facilities.

The search for the causes, means of diagnosis, and cures of cancer involves many scientific specialties, all of which are represented in the broad research programs of the Institute's staff and grantees. Growth processes, hormones, cell chemistry and mechanisms, cancer susceptibility and resistance, tumor-host relationships, nutrition and tumor growth, cancer-inducing and -destroying agents—all these and many more aspects of the problem are studied in an effort to gain the necessary knowledge to conquer this disease.

Injecting tumor-damaging drugs into eggs to measure toxicity by effect on embryos

One goal of cancer research is the discovery of chemical agents that will destroy tumors but not other tissues. Chemotherapy, the use of drugs, is becoming a valuable adjunct to surgery and radiation, the only curative treatments. Research in chemotherapy has been accelerated under a new national program, cosponsored by leading organizations and government agencies including the Cancer Institute. Thousands of compounds are being screened in laboratories throughout the country, with a view to finding drugs effective against cancer in man.

Much attention is also given to the effects of radiation upon normal tissues and cancer. Therapeutic uses of radioactive substances, the development and evaluation of supervoltage radiation, and attempts to prevent or modify the undesirable side-effects of radiation are important areas of investigation.

Hormones play a role in the development of cancer of certain tissues, such as those of the breast and reproductive organs. Moreover, changes in the hormonal balance of the body will retard some cancer for varying periods. These discoveries have greatly stimulated the study of hormones—endocrinology—as related to cancer growth. Contributions by Institute scientists include the development of new and superior methods of hormonal therapy and the synthesis of new compounds with hormone-like properties. One of these is five times as potent in biological assays as naturally occurring progesterone. Another gives promise of being useful in depressing hormonal secretions from the adrenal cortex.

Analysis of hormones excreted by cancer patients, in typical laboratory of Clinical Center

New leads in the attack on leukemia include the observations that the thymus gland appears to play a role in the development of this disease, that the ability of the lungs to remove white cells from the blood is impaired in leukemic persons, and that antifolic and antipyrimidine compounds together are more effective against experimental leukemia than is either compound alone.

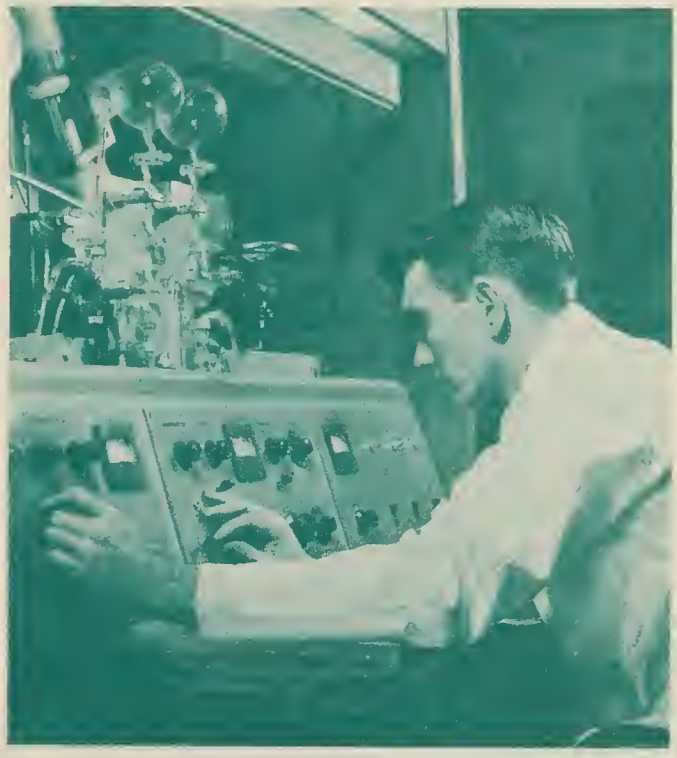
In a large proportion of cases, cancer gives no warning of its presence in internal organs until it has reached an incurable stage. Hence, the Institute conducts and supports many studies of diagnostic tests and case-finding procedures. Progress is being made on tests for cancer of specific sites as well as on a general test. A special area of Institute interest is large-scale field studies of the cytology test, which has proved particularly useful in detecting cancer of the uterus, lung, bladder, oral cavity, and stomach. Newly developed X-ray techniques with the supervoltage machine will make possible the detection of a higher percentage of early lung cancers.

Variations in the prevalence of some forms of cancer have been observed among persons living or working in different environments and among persons of different ethnic groups. The Institute conducts environmental and epidemiological studies in an effort to determine why such variations occur and how they might be prevented.

Improved nursing of the cancer patient is promoted through studies to determine needs and through activities to increase the nurse's ability to handle cancer problems in the hospital and community. Institute staff members conduct conferences and university courses for nurse educators, consultants, and supervisors. Nursing schools are assisted in integrating the subject of cancer into their basic curriculums, and nursing organizations are given consultive service.

Through the application of present knowledge, much can be done to reduce the suffering and deaths due to cancer. The Institute makes grants to the States to help support their cancer control programs and provides them with consultation. The State activities include surveys, studies, demonstrations, and the development and maintenance of cancer services and facilities.

Institute grants-in-aid support extensive educational programs, both undergraduate and graduate, for physicians, dentists, nurses, and other personnel concerned with the diagnosis and treatment of cancer, and thus increase the skilled personnel available to serve the cancer patient. To help keep the public acquainted with facts about the disease, the Institute utilizes publications, films, exhibits, and other educational media.



Separating isotopes with a mass spectrometer in research on turnover of tissue components

National Institute of Mental Health

This Institute was authorized by Congress under the National Mental Health Act of 1946. It is the focal point for the Federal Government's activities to gain knowledge about the causes of mental illness, to find more effective treatments, and to promote sound mental health. To meet these needs the Institute conducts a broad integrated program of research, training, community services, and public education.

During the past decade, mental illness has come to be widely recognized as a tremendous public health problem. The Nation's public mental hospitals contain about 600,000 patients, and the cost of their care and treatment, plus the cost of pensions to mentally disabled veterans, amounts annually to well over a billion dollars. In addition, the economic, social, and human losses occasioned by emotional disorders and mental illness are incalculably great. The lack of mental health underlies many of our most disturbing problems of family and community life, and prevents millions of people from functioning efficiently and achieving satisfactory relations with others.

Examining electrical record of convulsant activity in brain of a monkey

At present, the major problems in dealing with mental illness and in building sound mental health are these:

(1) The need for more knowledge about the causes and treatment of the various psychoses and emotional disorders. Although our knowledge is increasing, we still have much to learn about the brain and nervous system and about the nature of many of the mental illnesses.

(2) The need for more trained professional personnel to do research in mental health, to train others, and to provide services.

(3) The need for more mental health facilities of the type now in existence, such as clinics.

(4) The need for new types of service facilities to treat and rehabilitate, to prevent mental illness, and to build mental health throughout the community.

(5) The need for greater public understanding of the nature of mental illness and for increased public support in this field.

In its extramural program, the Institute awards grants to aid research in basic neurophysiology, neuroanatomy, and biochemistry, as well as in clinical psychology and psychiatry. Among the subjects studied are the psychoses, psychosomatic disorders, evaluation of therapy, drug addiction, and psychological aspects of aging.

In its own research program, the Institute emphasizes the interdisciplinary approach. It is believed that the causes of mental illness will probably be found to lie in a composite of factors ranging from the biochemical to the behavioral. The Institute laboratories emphasize physiological, pharmacological, and biochemical, as well as psychological and psychiatric investigations. Clinical studies are concentrated particularly on various types of schizophrenia, behavior disorders in predelinquent children, and psychosomatic disorders in children and adults. The search for metabolic factors in schizophrenia is given increasing attention.

On children's ward, a scientist and nurse observe behavior while participating in group activity

The Institute also conducts studies to find new approaches to such growing problems as juvenile delinquency and mental retardation. A long-term study of drug addiction is in process at the Public Health Service Hospital in Lexington, Ky.

Many more trained people are acutely needed in the psychiatric specialties, to staff the required facilities and to do research. To develop research potential, the Institute awards fellowships to promising young scientists. In addition, career-investigator grants provide long-term support of outstanding scientists who wish to devote a major part of their careers to the field of mental health.

To increase the number of trained mental health workers, the Institute awards grants that enable institutions throughout the country to expand their training of psychiatrists, clinical psychologists, psychiatric social workers, psychiatric nurses, and allied personnel. It also awards traineeships to students who wish to follow mental health careers, supports training seminars for the orientation of persons already in practice, and holds conferences to improve professional standards and education. Special career-teacher grants assist outstanding mental health educators, and most of the four-year medical schools receive Institute grants for the psychiatric orientation of physicians.

To aid in expanding the range of mental health facilities, the Institute assists States through technical consultation and services. It provides them with funds for the establishment of mental hygiene clinics, preventive programs in the schools, and other activities. Mental health programs are now under way in all States and Territories, with more than 1,200 child guidance and adult clinics in operation.

Staff members are frequently requested to give technical advice. These consultations have concerned such matters as civil defense and other disaster relief, promotion of mental health programs in schools, preparation of educational materials, and orientation of allied workers including nurses, teachers, lawyers, and ministers.

The Institute meets requests for personnel skilled in hospital administration to survey and advise on State mental hospital systems. It assists in collecting data about the mentally ill, develops programs for rehabilitating patients, and serves as a clearinghouse for information on mental health developments throughout the country. Educational activities are conducted in cooperation with professional, governmental, and civic organizations.

National Heart Institute

Separating enzymes by filter-paper electrophoresis in research on arteriosclerosis

Diseases of the heart and blood vessels cause approximately half of the deaths in the United States. The heavy impact of this problem is felt not only in loss of life, but also in disability, suffering, and extensive economic loss. Heart disease claims many of its victims prematurely, in their most productive years. About 10 million of our people have cardiovascular afflictions, and there are relatively few effective therapies. New knowledge must come from research. To help meet this serious national problem, Congress in 1948 established the National Heart Institute.

The research program of the Institute develops knowledge pertinent to an understanding of the structure, function, and abnormalties of the cardiovascular system. Understanding fundamental processes of a disease is the surest road to better means of countering it.

The Institute scientists attack a wide range of problems and apply a variety of disciplines. One area of activity is research in the chemistry of natural products, concerned with naturally occurring compounds of physiological importance. For example, a compound that depresses blood pressure in experimental tests has been isolated from the rhododendron plant and is now under laboratory and clinical study.

Investigators in cellular physiology and metabolism are attempting to translate to a cellular or organ level the advances made in the general field of enzyme chemistry and biophysics. The means by which cells utilize the chemical energy of foodstuffs for such processes as muscular contraction are studied, as are the factors implicated in the development of atherosclerosis, the major form of hardening of the arteries.

Pharmacological research is aimed at the development of better drugs for the treatment of diseases of the heart and blood vessels. For example, studies of the pathways by which drugs are broken down in the body permit the design of drugs for specific purposes, such as an anesthetic that loses effect as soon as administration is stopped—a highly desirable feature in surgery on elderly and cardiac patients.

The study of medical physiology is concerned with such matters as the mechanisms by which blood vessel size, and thus blood pressure, are regulated, and with factors related to the distribution of important salts in the body. In studies of kidney function, a recent accomplishment is the demonstration that the failure of salt excretion by the kidney, which leads to edema (dropsy) in heart failure, involves an increase in the activity of the adrenal glands.

Technical developments are providing a number of useful devices for the detection, diagnosis, and study of disease by physical means, and for the facilitation of laboratory and clinical research.

Studies are being conducted on the physiological, biochemical, and psychological changes that take place in aging people. One technique for evaluating the effects of aging on blood vessels walls is

based upon the capacity of these vessels to transmit an externally applied impulse.

Institute research in surgery seeks to improve surgical procedures for the correction and alleviation of disorders of the heart and blood vessels. Great strides have recently been made in this field, and many potentialities remain.

In general medicine and experimental therapeutics, new techniques, instruments, and drugs, some of them developed in laboratories of the Institute, are being evaluated, with emphasis on hypertension (high blood pressure).

Laboratory investigations are the foundation of heart research and demand the greatest part of the work. Clinical application, however, is the topmost stone of the pyramid. The facilities of the Clinical Center provide the opportunity to carry significant work to actual clinical trial, with minimum delay. The Heart Institute also conducts or participates in research at various hospitals.

In addition to its laboratory and clinical research at Bethesda, the Institute is conducting a long-term community study at Framingham, Mass. This may provide definite information as to what characteristics are present in people who develop heart disease. The project involves a detailed physical reexamination every 2 years of over 5,000 adults between the ages of 30 and 60.

Other important parts of the Institute's attack on heart disease are the extensive program of grants for research in universities and hospitals, and training programs of three types—research fellowships, clinical traineeships, and teaching grants to medical schools. Other functions include biometrics research and public and professional information activities. Aid to the States in developing community heart disease programs is given in cooperation with the Bureau of State Services of the Public Health Service. The National Heart Institute spearheads the total Public Health Service attack against heart disease, actively cooperating with other agencies and organizations in an accelerating drive.

The past few years have witnessed much progress. Advances in basic knowledge, in surgery, and in the development of drugs and techniques have strengthened hopes that the Nation's leading killer is not invincible. Yet the larger portion of the task remains. The underlying factors responsible for rheumatic, hypertensive, and arteriosclerotic heart disease—which account for 90 percent of all heart deaths—are still unknown. The search for the causes of these diseases and for means of controlling them, an expanding nationwide effort, may prevent much untimely death and disability in the not-too-distant future.

Apparatus for isolating biological materials, used in studying action of drugs

National Institute of Dental Research

Evaluation of dental efficiency as a variable in metabolic studies

The major dental problem of the Nation is dental caries, or tooth decay. Among children aged 15, over 95 percent have decayed permanent teeth and the average child has lost two teeth from lack of treatment. The average adult will have lost half his teeth by the time he reaches 40.

Also extremely prevalent are diseases of the gums, bones, and other supporting tissues. These are collectively called periodontal disease, or pyorrhea. Six out of every seven people are ultimately afflicted with this baffling condition—the main cause of tooth loss in adults.

Malocclusion, or the incorrect relation of teeth or jaws to each other, is a serious problem in at least one out of ten children. Cleft lip and palate is a congenital condition occurring once in every 800 births. Other problems include oral cancer, virus infections, and the adverse effects of dental disorders upon general health.

The American people spend over a billion dollars annually for dental care, and many additional millions are spent by the Armed Forces and the Veterans' Administration. Not only do these expenditures promise no permanent solution to the Nation's dental problem, but adequate service is reaching only about a third of our population.

The Public Health Service, looking toward the eradication of dental disease, approaches the problem through fundamental research and the development of preventive measures. Meanwhile, other aspects of the program are designed to further the application of present knowledge.

The objectives of the National Institute of Dental Research are to increase knowledge of dental and associated diseases, with a view to improving oral and general health. The program is divided into three broad categories: (1) laboratory and clinical research conducted by the staff, (2) support of research projects in non-Federal institutions, and (3) activities to expand the Nation's pool of dental research scientists.

Many of the projects derive from a discovery made in 1938 by NIH workers, who showed that the element fluorine in drinking water can give substantial protection against dental caries. Determination of the proper concentration of fluorine and the ruling out of any harmful side effects were further achievements. These results have led to fluoridation of public water supplies serving more than 22 million people.

A long-term study begun in 1944 at Grand Rapids, Mich., has shown that fluoridation reduces tooth decay about 65 percent in young children. The extent to which the teeth of older persons are protected will be learned through further evaluation and the passage of time.

In addition to the Grand Rapids study, the Institute is continuing laboratory experiments to learn more about the role of fluorine and its compounds in metabolism. Populations in regions of high natural fluoride levels are being observed for long-term effects. In a Texas community that had used water with eight times the recommended fluorine

content, no adverse medical effects were detected over a 10-year period.

Besides these studies, the Institute staff, grantees, and fellows seek a better understanding of normal teeth and the factors leading to dental disorders. Investigations are pursued in oral bacteriology, biochemistry, and biophysics. For example, scientists at the Institute are exploring enamel and dentin with the electron microscope, which permits highly precise observation of structural changes. Thus the pathways by which bacteria penetrate the tooth are studied with relation to the breakdown of various tissue components.

The several types of bacteria associated with oral disease, as well as the use of antibiotics and other therapeutic agents, are also being investigated. In other projects the study of nutrition in relation to dental caries presents exciting possibilities. Foods subjected to high temperatures during commercial preparation have been shown to increase tooth decay in experimental animals.

Opportunities to extend fundamental knowledge in the field of dental health were substantially increased with the opening of the Clinical Center. Research projects of basic character are in progress or being planned. Among these are clinical studies on the effects of radiation on oral tissues, the use of therapeutic drugs in the orál cavity, the healing of wounds, development of neurological disorders of oral origin, treatments for malocclusion, the origin and treatment of periodontal diseases, and anesthetic compounds and techniques.

Cultivating bacteria from saliva of school children in fluoridation study at Grand Rapids

Electron micrograph showing bacteria in carious enamel, at 20,000 times actual size

The research grants program of the Institute has contributed significantly to the knowledge of underlying factors in dental health and disease. It has been shown, for example, that artificial fever induced in pregnant rats causes dental malformations in the mother and offspring. In another study, a cancer-inducing agent, methylcholanthrene, changed the microscopic appearance of embryonic "tooth germs" to resemble that of malignant tumors. Of possible clinical significance is the discovery that the general health of individuals is reflected in the tissues of the mouth, suggesting a new approach to early diagnosis of health disorders.

The wide field of dental research offers unlimited opportunities for young scientists. Through full-time postgraduate fellowships, the Institute is helping to develop manpower in a variety of basic research fields. In addition, a fellowship program for predoctorate training was recently inaugurated in schools of dentistry throughout the country.

National Institute of Neurological Diseases & Blindness

No system of the human body is liable to permanent damage so quickly as the central nervous system. The surgical patient's heart that has been revived minutes after its beat has stopped may show no signs of damage, but once the circulation of blood and oxygen ceases, deterioration of the brain begins. After five minutes, so many brain cells have died that the patient will usually be permanently crippled.

Damage or destruction of sensitive tissues of the central nervous system or of the eye and ear results in some of mankind's most dreaded disorders—poliomyelitis, cerebral palsy, multiple sclerosis, epilepsy, muscular dystrophy, Parkinsonism, and many conditions causing blindness and deafness. These are among the 200-odd disorders that constitute the leading cause of permanent disability and the third cause of death in the United States. They are the research responsibility of the National Institute of Neurological Diseases and Blindness.

The research attack of the Institute is exceedingly varied. To understand the abnormalities that characterize neurological disease, and thus possibly to reverse them, the normal growth, activity, and functions of the nervous system must be defined. Science is therefore concerned with such problems as the physical and chemical nature of nerve cells, the means by which electrical energy is generated within them, and the ways that various cell areas combine to effect the body's activity. These studies are complex. The brain alone comprises more than four billion cells, each with a separate role in the processes of thinking, moving, seeing, hearing, and even digestion.

The attack on the neurological and sensory disorders focuses also on disease itself. So it is, for example, that research is dedicated to the development of new and better drugs for controlling epileptic seizure. So it is that studies are made into the causes of multiple sclerosis, cerebral palsy, cataract, and glaucoma.

The methods employed in such research vary considerably. Some investigators, such as the pharmacologists, attempt to create new antiseizure drugs by altering the structure of those already known to affect epilepsy. Others, the biochemists, compare epileptic and normal tissues in an effort to determine whether an insufficiency or excess of chemical substances underlies the abnormality. And in some instances, several specialties must coordinate in a single study.

This is true of a study that has led to means for arresting a blinding eye disease, uveitis due to toxoplasmosis. Many projects in the field of blindness call for cooperative investigation of the suspected causes, diagnostic methods, effectiveness of drug therapy, and new surgical techniques. The interdisciplinary approach is also used in fundamental research into the growth and function of the brain and nervous system.

A study now under way in the Clinical Center illustrates a full coordinate attack on a medical

Collecting samples of sodium and potassium from muscle in research on neuromuscular disease

Instrument for recording electrical activity of single nerve cells in experimental animals

problem. One sample of muscle obtained from a patient with muscular dystrophy must be examined by a neuropathologist, who verifies the diagnosis; by a muscle chemist, who tests the contractile power of the sample; and by a biochemist and biophysicist, who employ radioactive tracers to measure components of muscle and blood. A neurologist and neurosurgeon also participate.

The discovery of a basic metabolic defect concerned with epileptic seizures will illustrate biochemical research in neurology. Animal and clinical studies at the Institute revealed an inability of epileptic brain tissue to retain glutamic acid, a substance essential to normal structure and function. Accordingly, glutamine and asparagine, natural substances closely related to glutamic acid, have been administered to patients. During these trials, previously intractable seizures have been wholly or partially controlled.

One of the most significant areas of neurological investigation concerns the regeneration of nerve tissue. Such chronic conditions as cerebral palsy and paraplegia are due to the destruction of tissue in the nervous system. If this destruction could be reversed, a successful treatment for several major disorders would have been achieved.

A decade ago, this objective would have been considered impossible. We are still not sure that it is possible; but within recent years, spinal cords severed in animals have been partially repaired through administration of an agent made from dead bacteria. This research affords substantial hope for further progress.

Many complications may present themselves. For example, even if nerve tissue, like any other tissue, can be made to regrow in humans, problems may arise such as how to control the growth so that the nerve fibers resume their natural positions and function. The solution may necessitate painstaking experiments concerning the origins and growth of the nervous system, now but little understood.

The quest for means of alleviating, controlling, or reversing the progress of neurological and sensory disorders has begun in earnest. The past decade has seen many major developments—new drugs for the control of epilepsy, Parkinsonism, and myasthenia gravis; new drugs and surgical procedures for cataract and glaucoma; and total rehabilitation as a means for the disabled to attain personal and economic adjustment. With the impetus lent to neurological science through the program of the National Institute of Neurological Diseases and Blindness, there is every reason to believe that these advances will continue.

Adjusting Warburg apparatus in determining ratio of oxygen to carbon dioxide in brain tissue

Clinical Center

The Clinical Center symbolizes the remarkable increase of public interest in medical research since World War II. Congress in 1947 authorized its establishment to provide clinical study facilities and additional laboratory space at NIH. Construction was begun the following year, and the first patients were admitted on July 6, 1953. The full capacity of the Center is 500 patients and approximately 1,100 laboratory units.

Antedating all scientific specialties, and more important now than ever before, is the study of health and disease in individuals. This is the science of clinical medicine as practiced since ancient times by physicians in homes and hospitals. To a great extent, medical knowledge has grown by just this process. In observing sick humans and attempting to restore their health, physicians are constantly acquiring new evidence concerning the causes of illness, and developing better methods of diagnosis, prevention, and treatment. Today this process of observation and discovery is accelerated by special research facilities such as the Clinical Center.

If medical knowledge is to continue to advance, sharp lines cannot remain between various health problems and scientific approaches. Here is where clinical medicine, which concentrates on the whole man, serves its greatest research mission. The Clinical Center was planned so that representatives of all the medical sciences could work together closely with clinicians, contributing not only to one another's research but also to the more effective treatment of patients. The Center was equipped so that every research tool needed by these workers would be available.

The division of space in the Clinical Center reveals its coordinating function. Each Institute has patient bedrooms and research laboratories in close proximity. The facilities for diagnosis, medical and nursing care, social service, rehabilitation, and recreation are comparable to those found in any good modern hospital. The laboratories are so designed that they can be readily modified to meet the changing requirements of research with a minimum of delay and expense.

That the Clinical Center is more than a hospital is illustrated by the way patients are admitted. Patients are received solely because they have a

Patients attend service in chapel; altar can be rotated for different faiths

In diagnostic X-ray department, preparations are made for radiography of heart and large vessels

condition needed in a particular study by one of the seven Institutes sharing the Center. They must be referred by individual physicians or other qualified medical sources, after advance negotiations with the Center physicians. Hospitals, clinics, family physicians, and specialists in various diseases not only refer their patients, but through consultation, follow-up treatment, and observation, actively participate in the research.

Many studies depend upon the patients' remaining in the Center for long periods—often 3 or 4 months. After discharge, follow-up examinations or treatment may be given periodically for a few months to 10 years or more—a most important procedure in medical investigations. Special facilities for the comfort and morale of patients encourage them to stay for the entire time they are needed and to return to the Center upon request.

As in every good hospital, the medical and surgical care received here is based on the ruling concept that the welfare of the patient has priority over all other considerations.

The methods of treatment employed are substantially the same as those accepted and used by well-qualified physicians everywhere. Far more extensive and frequent, however, are the laboratory tests and other examinations made for research purposes. All clinical studies are reinforced by fundamental laboratory investigations. Conversely, many laboratory investigations are stimulated and enhanced through the close relations maintained with clinical medicine.

Much of the above is summarized in six basic principles that have guided NIH in its clinical research program:

(1) The Clinical Center is a research center and not a medical care facility.

(2) Patients selected as research subjects are given medical care of the highest quality.

(3) The design and operation of the Center foster interchange of ideas and skills among all the major biological and medical specialties—basic laboratory, preclinical, and clinical.

(4) Resources of the Center are available for collaborative research by established scientists from other institutions, and opportunity is provided for able young clinicians to gain specialized training for independent careers in research medicine.

(5) In assembling the staff, every effort is made to minimize the impact on local medical and educational institutions.

(6) In obtaining patients for study, close collaboration is maintained with physicians, hospitals, medical schools, and clinics—the purpose being not to interfere or compete, but rather to permit medical practice, teaching, and research to proceed together in harmony.

Division of Biologics Standards

Scanning tissue culture cells for presence of virus in safety testing of vaccine

Federal control of biological products for human use began with the passage of the "Biologics Control Act" in 1902. The present statute, though there have been some changes, is basically the same. It regulates the manufacture and sale of vaccines, toxins, antitoxins, blood derivatives, and analogous products applicable to the prevention and cure of diseases in man.

Many biological products are derived from virulent microorganisms, and all are potentially dangerous if improperly prepared and tested. Close surveillance of production and constant improvement of quality are essential. These are responsibilities of NIH. To meet increasing demands, the Division of Biologics Standards was created in June 1955, replacing the Laboratory of Biologics Control.

The Act provides for licenses of two types—establishment licenses and product licenses. Biologics produced under the Act can be imported, exported, or placed in interstate commerce only if they meet the Public Health Service's standards of safety, purity, and potency. The manufacturers give wholehearted cooperation to this authority, which ensures the greatest benefits with the least risk to the consuming public.

As designated by the Surgeon General, the specific aim of the Division is to develop an organization capable of exerting leadership in the field of biologics, based on the concept that their control should rest on a foundation of research. The staff conducts studies, for example, on the fundamental aspects of bacterial and viral infection. Results are contributing to the development of methods for the control of new products and are helping to improve the older ones. For instance, the Clinical Center Blood Bank, operated by the Division, provides an opportunity to improve techniques of blood collection, processing, and transfusion.

The Division is prepared to meet new needs occasioned by the expanding range of diseases to which biological products are applicable and the accelerated discovery of such products, particularly in the field of virology. The antibiotics and sulfa compounds have made little impression on the common virus infections. But principles utilized in the development of a successful poliomyelitis vaccine offer promise of solutions to such baffling problems as mumps, measles, and influenza. It is anticipated that potent biologics yet to be developed will greatly increase the Division's responsibilities.

The control functions of the Division are to recommend the licensing of manufacturers of biologics, to establish standards for a given product, and to see that such standards are maintained. This third function is performed through regular inspection of the manufacturing plants, review of protocols of the manufacturing process, and testing of the product. The tests employ animal inoculation, tissue culture, and other methods to ensure that the requirements for safety, purity, and potency are fulfilled.

Central Services

Late in 1955 a number of centralized services at NIH were reorganized to form the Division of Research Services and the Division of Business Operations. Subsequent integration and expansion have enabled these groups to give more adequate support to the Institutes' research programs.

This is no small task, for the medical scientist of today, in order to make maximum progress, requires highly skilled teams of auxiliary personnel. These must aid in the laboratory, furnish statistical and engineering services, assist in scientific communication. They must manage funds, obtain workers and supplies, and constantly analyze the institution's operations in the interest of top efficiency. Such services have done much to accelerate medical science in recent years.

A few words about the central services at NIH will illustrate this contribution. In the Division of Research Services, a biometrics branch applies statistical techniques to medical research problems. The biometrician may be asked to determine whether a given disease is related to a certain occupation, or whether the results of a series of experiments form a meaningful pattern. Nothing is more characteristic of modern medical investigation than the posing of such problems and the use of biometrics in their solution.

The scientist works at the frontiers of knowledge. Before commencing a project, he must know what others have reported in that area. Thus, the Division maintains an extensive, timely library and a translating unit for the Public Health Service. And because the scientist and his institution are obligated to report his results, both to professional workers and to the public, the Division also provides editorial and reporting services. Medical art and photographic services are integrated with these.

Precision instruments, specially bred animals, and other materials needed for research are often not available from commercial sources. The Division operates an animal production section and hospital, headed by veterinarians. Craftsmen design and construct instruments to the scientist's specifications. Carpenters, electricians, machinists, and other workers build and repair equipment. And plant and sanitary engineers meet the special needs of a medical research institution.

The Division of Business Operations, on behalf of scientists and administrators, makes all the formal transactions of NIH concerning finances, personnel, office services, and supplies. In establishing or modifying NIH programs, the first step is often one of analysis. A management analysis branch within the Division has contributed notably to the procedures for processing grant applications and to the operation of the Clinical Center. Another branch performs such centralized financial functions as budget management, accounting, and auditing; and yet another is responsible for the procurement and management of supplies and property. Budgeting and procurement for the diverse and constantly changing programs of NIH require special knowledge and techniques.

Transportation, communications, housekeeping, and other office services are also furnished by the Division. Plant safety is entrusted to sections on radiation, fire, civil defense, and the guard force. A Board of U. S. Civil Service Examiners aids in the recruitment of personnel for NIH and other Federal bureaus conducting medical research.

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Besides the regular fellowships, NIH awards five-year *senior research fellowships* to foster additional investigation in the basic sciences, and *special research fellowships* to help the mature scientist gain further experience in his field. Through a *visiting scientist program*, prominent scientists participate in research at NIH for limited periods.

The national volume of medical research has grown substantially because of these extramural operations. Another major effect of the program has been to stimulate research in neglected fields, particularly on some of the chronic diseases.

TRAINEESHIPS AND TRAINING GRANTS

Research manpower bears a crucial relation to the Nation's health. The quality and volume of medical research is directly proportional to the caliber and number of workers devoted to the medical and biological sciences. For the present, the Nation's competent medical investigators need more assistance. For the future, manpower shortages threaten to limit the acquisition of new knowledge, and the demands for scientific workers in all fields are steadily increasing.

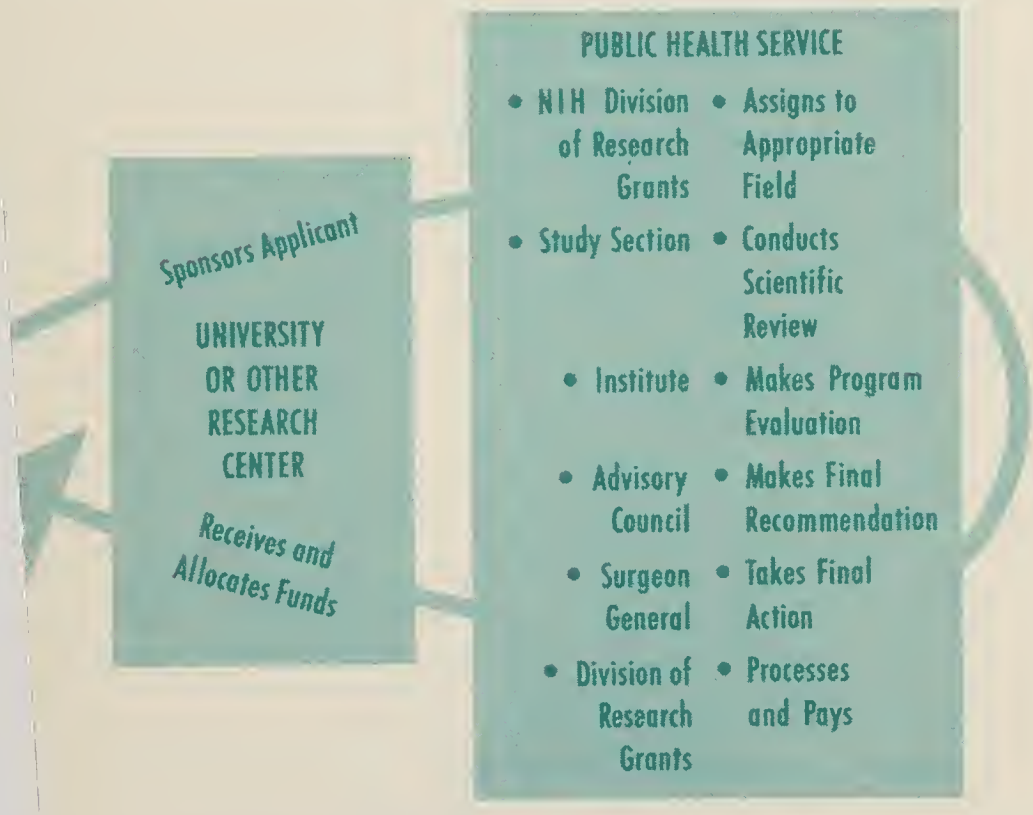
Closely related to the problem of research manpower is the acute need for physicians with special competence in cancer, heart disease, arthritis, and other fields. Clinical research depends primarily upon physicians with advanced training.

NIH, besides awarding fellowships, approaches these manpower problems through programs of two types. Several of the Institutes conduct *traineeship programs* to increase the number of physicians and certain allied workers engaged in specialized clinical practice. The essential difference between the traineeships and fellowships is that the former relate primarily to the practice of medicine; the latter, to medical research.

The *training grants* to educational institutions help equip medical students and professionals in certain related fields with the latest medical knowledge. This has been largely accomplished through the development of courses in the fields of heart disease, cancer, and mental illness. The cancer training grants, for example, have been extended to all the medical schools of the Nation.

Through its extramural programs, NIH contributes not only to the medical progress of today, but also to that of the future.

HOW A RESEARCH GRANT IS MADE



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Research Grants and Training

The program of the National Institutes of Health extends far beyond the research conducted in its own laboratories. Approximately two thirds of the funds appropriated to NIH support research and training in non-Federal medical institutions. Specifically, the disbursements consist of grants to support research projects, fellowship awards to develop research talent, traineeship awards to provide special clinical training, grants to promote control of disease, and grants to assist in improved teaching or training in certain medical areas.

In conducting this extramural program, the Institutes are aided by seven National Advisory Councils composed of citizens outstanding in medical science, education, and public affairs. The Councils review all applications for research, teaching, and training grants, and recommend appropriate action to the Surgeon General of the Public Health Service. He may award such grants only upon Council recommendation. The Councils also advise the Surgeon General on policy.

DIVISION OF RESEARCH GRANTS

The focal point of responsibility for administration of all research grant and fellowship programs at NIH is the Division of Research Grants. Its functions include receipt of applications, processing, assignment, payment, and auditing. In addition, the Division is fully responsible for the grants and fellowships in study areas not encompassed by the program of any Institute.

The major objectives of the *research grants program* are to expand research in medical schools, hospitals, and other institutions; to stimulate new investigation in neglected fields; and to provide training for scientific personnel. The grants support a broad spectrum of laboratory and clinical research in the medical and biological sciences.

To assist the National Advisory Councils, the Public Health Service has established within the Division a series of consultant groups known as Study Sections. These are composed of authorities in the major areas of research. Most of the members are nongovernmental scientists selected by the Surgeon General from all parts of the country. Members of the Study Sections and National Advisory Councils serve four-year terms, and the turnover is gradual.

To promote the highest quality of research, every effort is made to ensure the scientific freedom of the grantee. He is not required, for example, to follow the original proposal rigidly, but rather is free to pursue the project in whatever manner he wishes and to publish his findings without clearance with the Government.

The *research fellowships program* of NIH provides financial assistance to promising American scientists during their training period, so that they can enter careers in medical research and allied fields. These fellowships are awarded by the Surgeon General on a competitive basis upon the recommendation of scientific committees established by the Division. A research fellow may conduct his work at any institution where interests, guidance, and facilities are suitable. This program is an approach to the urgent problem of increasing the scientific manpower of the United States. Nine out of ten fellowship recipients remain in medical research after their training.

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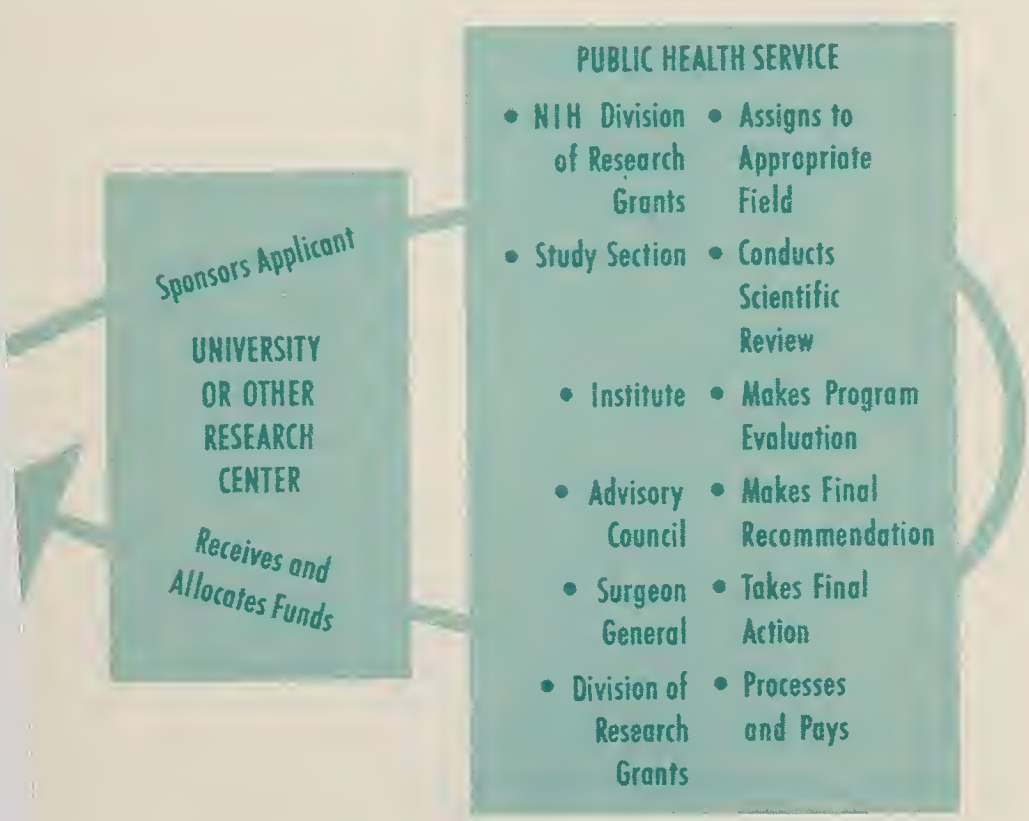

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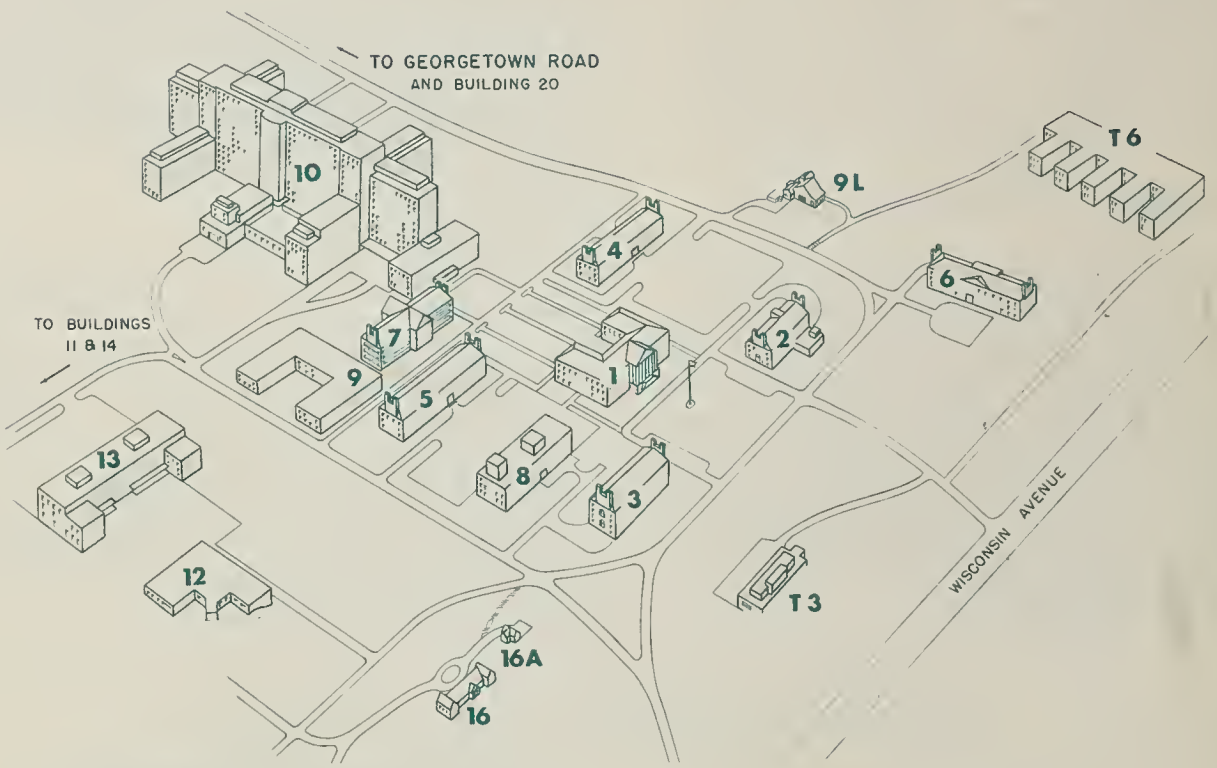

1 Administration
2 Dental, arthritis and metabolic research
3 Heart, arthritis and metabolic research
4 Arthritis and metabolic research
5 Allergy and infectious diseases research, biologics standards
6 Cancer research
7 Memorial Laboratory (allergy and infectious diseases research)
8 Biologics standards, neurological research, central services
9 Neurological, mental health research
9L Top Cottage
10 Clinical Center
11 Boiler plant
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16 Stone House
16A Offices
20 Apartment house (quarters)
T3 Isotope Laboratory
T6 Offices (grants and fellowships, cancer, mental health)

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